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## OVERNIGHTING OF GOLDEN-CROWNED KINGLETS DURING WINTER

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**ABSTRACT.**—The Golden-crowned Kinglet (*Regulus satrapa*) is the smallest insectivorous bird that overwinters in boreal forests across North America from Alaska to Nova Scotia, where nights may last 16 h and nighttime temperatures may fall below  $-40^{\circ}\text{C}$ . I here provide the first documentation of Golden-crowned Kinglets huddling in the field during winter on open branches. The birds forage until darkness and do not necessarily come back every night to the same site. Traveling in groups and huddling where they end up in the darkness compensates for small body size and potential compromises in foraging time. *Received 28 March 2003, accepted 11 June 2003.*

How 5- to 6-g kinglets can maintain energy balance to survive the long nights at low temperatures has long been an enigma (Ingold and Galati 1997). In winter these birds forage uninterrupted during the day, feeding predominantly on hibernating caterpillars (Heinrich and Bell 1995). Blem and Pagels (1984) calculated that the fat reserves accumulated during the day in midwinter are insufficient to support endothermy at ambient winter temperatures for an entire night, suggesting that the birds employ torpor, huddle, and/or spend the night in uniquely insulated shelters. However, Reinertsen et al. (1988), working with Goldcrests (*Regulus regulus*) in Austria, found no torpor in captive (presumably well-fed) birds that huddled at night (Thaler 1990) on open branches. Blem and Pagels (1984), on the other hand, saw one Golden-crowned Kinglet (*R. satrapa*) in the wild that apparently entered a squirrel nest.

In the woods of western Maine, the site of the present observations, kinglets routinely travel in mixed species flocks with Black-

capped Chickadees (*Poecile atricapillus*), Red-breasted Nuthatches (*Sitta canadensis*), and occasionally Downy Woodpeckers (*Picoides pubescens*) and Brown Creepers (*Certhia americana*). Downy (Kilham 1983) and Hairy (*P. villosus* pers. obs.) woodpeckers excavate holes in fall and winter for shelter during the night, and Red-breasted Nuthatches routinely enter preexisting tree cavities at dusk (pers. obs.). At least one small insectivorous North American bird, the Verdin (*Auriparus flaviceps*) builds winter nests (Walsberg 1990) and therein huddles in groups. The energy consideration of Blem and Pagels (1984) suggested that kinglets may employ some unusual strategy.

In dozens of attempts to follow kinglets during late afternoon and evening, I occasionally was successful in following them for over an hour and until dark, but they always vanished from sight as it was getting too dark to see (i.e., they foraged until after sunset). During early January, 1995, I had on three occasions followed a group of three kinglets at dusk to where I had previously located two red squirrel (*Tamiasciurus hudsonicus*) nests. The birds “disappeared” in a balsam fir (*Abi-*

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*es balsamifera*) thicket. No kinglets could be flushed from the squirrel nests, nor were any seen to leave them at dawn.

On 19 December, 2000, after a night of heavy winds with driving sleet and snow, I flushed two kinglets in the predawn darkness from near the ground out of a snow-covered brush pile. No kinglets returned to this shelter during the next two evenings.

On 25 November 2002, I saw three kinglets while I was perched about 12 m up in a spruce (*Picea* sp.) tree. As it was starting to get dark (10 min past the official sunset of 16:05 EST) I heard "tsee" calls and then saw a kinglet land on a twig near me. It turned around several times and a second one joined it. The two pressed closely together and then stopped moving. The two then separated briefly after a third bird arrived, but then they rejoined each other to again huddle on the same branch. The third bird called from a dense neighboring balsam fir tree. The two then left their huddle and joined the third one. All three birds then were invisible to me, but several minutes later I heard "tsee" calls from near where they had disappeared from my view into the dense foliage.

The following evening I again first heard and then saw three kinglets in the same area, and they again disappeared into the same dense thicket. I monitored the area for two more nights, occasionally hearing a kinglet but being unable to follow one. This site contained a red squirrel nest. On each of the four evenings, the squirrel returned to its nest about 30–60 min before the kinglets arrived. I watched the nest closely but did not see any kinglets enter it.

On the evening of 27 December 2002, at 16:20 (after the sun was below the horizon but it was not yet dark) I saw three kinglets fly into a brushy white pine (*Pinus strobus*). In less than a minute I found four kinglets huddled together about 4 m above the ground under thick branches. I returned an hour later and from a step ladder examined the birds in the beam of a flashlight. The birds' chests were pointing inward and their tails pointing outward in three directions. The birds showed no reactions to repeated photographic flashes from a distance of 20 cm (Fig. 1) and their heads remained fully tucked into the back

feathers. One bird jerked its head up when I jiggled the roost, and then just as quickly retracted it back into its fluffed out feathers. Temperatures then were  $-4^{\circ}\text{C}$ , but later that night declined to  $-10^{\circ}\text{C}$ . I again checked the birds at 19:30 and in the predawn at 04:30. As before, the tail positions had not shifted and rapid breathing movements were visible; the birds apparently were not in torpor. No birds were seen at that site during the next week.

Hundreds of observations of Golden-crowned Kinglets during winter in western Maine indicated that these birds always traveled in groups of two to four. The kinglets commonly join up with chickadee flocks, but separate from them in the evening.

The present observations indicate that although microhabitats for nocturnal roosts are likely important, overnighting sites may be less specific and less important than the ability to huddle quickly. Overwintering Golden-crowned Kinglets apparently do not generally return to the same site each night. Instead, they forage until nightfall and huddle tightly near where they end up.

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